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Validity and Reliability of the Turkish Form of Technology-Rich Outcome-Focused Learning Environment Inventory

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Abstract

The purpose of the study was to investigate the reliability and validity of a Turkish adaptation of Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) which was developed by Aldridge, Dorman, and Fraser. A sample of 985 students from 16 high schools (Grades 9-12) participated in the study. Translation process followed translation committee, back translation, and decentralizing methods by teacher educators. Once equivalency of the Turkish form was established, the construct validity of the scale was examined with exploratory factor analysis followed by the confirmatory factor analysis which tested the original scale model. Additionally, Cronbach alpha correlation coefficients, corrected item-total correlations, and t-tests between items' means of upper 27%-lower 27% points were calculated. In contrast to original 80 items scale, Turkish form of TROFLEI consisted of 77 items after 3 items were dropped. Exploratory and confirmatory factor analysis results supported the original 10 factor structure. The Cronbach alpha coefficients varied between 0.81 and 0.92. Corrected item-total correlations ranged from 0.33 to 0.67. According to t-test results, differences between each item's means of upper 27% and lower 27% points were significant. Goodness of fit indices of confirmatory factor analysis indicated a good fit between the original model and data (χ^2 /sd=2,95, RMSEA=0.051, RMR=0.078, SRMR=0.056, CFI=0.97, TLI=0.97). The results of this research provide strong evidence of the sound psychometric properties of Turkish form of TROFLEI.

Key Words

Learning Environment, Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI), Scale Adaptation

Research on the relationship between students' achievement and the quality of the classroom learning environments (Goh, 2002) is abundant and findings from these studies justified that there is a strong relationship between these two concepts (Fraser, 1991; Köse & Küçükoğlu, 2009). Unfortunately, a great attention is given to student achievement whereas only little attention is paid to the learning environments (Fraser, 2002). Undoubtedly; assessment of the classroom environment provides clues about how classrooms should be organized. Studies have revealed strong ties between the learning environment variables and students 'cognitive and affective learning products and related students' perceptions of their learning environment with their learning (den Brok, Brekelmans, & Wubbels, 2004; Fraser, Aldridge, & Adolphe, 2010). Instruction and learning can be improved with a systematic review and evaluation of learning environments (Hofstein, Nahum, & Shore, 2001). Using instruments directly in different countries is almost impossible because of the constraints on

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spoken language, cultural, and social differences. In this respect, MacLeod and Fraser (2010) indicated that translations of validated learning environment questionnaires have provided valuable tools for researchers in many countries.

Since the Harvard Physics project (Walberg & Anderson, 1968), studies of classroom learning environments have grown increasingly over the past 40 years. Numerous instruments, such as the *Learning Environment Inventory* (LEI; Walberg & Anderson, 1968), *Classroom Environment Scale* (CES; Moos, 1979), *Individualized Classroom Environment Questionnaire* (ICEQ; Fraser, 1990), *My Class Inventory* (MCI; Fisher & Fraser, 1981), *College and University Classroom Environment Inventory* (CUCEI; Fraser & Treagust, 1986), *Science Laboratory Environment Inventory* (SLEI; Fraser, Giddings, & McRobbie, 1995), *Constructivist Learning Environment Scale* (CLES; Taylor, Fraser, & Fisher, 1997), *Questionnaire on Teacher Interaction* (QTI; Wubbels & Levy, 1993), and *What is Happening in This Class? Questionnaire* (WIHIC; Fraser, Fisher, & McRobbie, 1996). The robust nature of the What Is Happening In this Class? (WIHIC) questionnaire, in terms of reliability and validity, has been widely reported in studies that have used the instrument in different subject areas, at different age levels and in nine different countries (Dorman, 2003), including Turkey (Telli, Çakıroğlu, & den Brok, 2006). There is an urgent need for instruments that assess and evaluate learning environments in Turkey. den Brok, Telli, Çakıroglu, Taconis, and Tekkaya (2010) reported that learning environment research in Turkey should focus on developing instruments for measuring students' and teachers' perceptions of learning environments and use such knowledge in order to improve the instructional practices. Learning environment instruments are constantly being revised and updated. One of such current effort was to develop and validate Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI; Aldridge, Dorman, & Fraser, 2004). The purpose of the study was to investigate the reliability and validity of a Turkish adaptation of TROFLEI. The TROFLEI includes ten scales: student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation, equity, differentiation, computer usage, and young adult ethos. The questionnaire has two sections: actual, which records what students perceive from what is happening in the classroom and preferred, which records what students would prefer to happen in their class. The items are measured on a five point Likert scale: Almost Never, Seldom, Sometimes, Often, and Almost Always. The data from Turkish actual form are analyzed and reported in this study. In a similar study, Gupta and Koul (2007) adapted and validated TROFLEI in India.

Method

A sample of 985 students from 16 high schools (Grades 9-12) participated in the study including %45.3 (n=446) male, %54.7 (n=539) female. The translation process was a combination of the three translation protocols: (*a*) a translation committee (Nasser, 2005), (*b*) back-translation, and (*c*) the decentering method (Brislin, 1986). In the first step, researcher and two colleagues independently translated the instrument from the source language of English to the target language of Turkish. The researcher compared all three translations and prepared a draft of the Turkish instrument. He sent the original TROFLEI along with the Turkish draft to four other bilingual colleagues and asked if they agreed with the translation. They indicated for each item whether they agreed with the translation or not; if they did not, they proposed an alternative. All of these persons have PhDs in Education either from American or British universities and they work at Colleges of Education in different universities in Turkey. Finally, the Turkish researcher and another colleague assessed and discussed the responses and prepared the final version. The back-translation process was performed by three persons who speak both English and Turkish. One of them was a Turkish scholar who is a department chair at the American University. All three back translations were compared by a monolingual English-speaking individual because Sireci and Berberoğlu (2000) claim that it can be problematic for the final comparison to be made by bilingual individuals.

Once equivalency of the Turkish form was established, the construct validity of the scale was examined with exploratory factor analysis followed by the confirmatory factor analysis which tested the original scale model. Cronbach alpha correlation coefficients and corrected item-total correlations were calculated. In addition, the differences between items mean scores, and factor means of the upper 27% and lover 27% were examined by the t-test.

In confirmatory factor analysis a host of fit indices are available and there is no consensus on which ones are the best and should be considered and reported (Tanguma, 2001). For example, in technical reports on the PISA implementation RMSEA,

Table 1.
Results of Confirmatory Factor Analyses for Turkish Actual Form of the TROFLEI

Factor	Loading of A priori Scale Item on Factor							
	1	2	3	4	5	6	7	8
Student Cohesiveness	.53	.37	.47	.64	.73	.58	.60	---
Teacher Support	.92	.93	.95	.91	.97	1.05	.93	.70
Involvement	.82	.80	.67	.89	.71	.80	.84	.74
Investigation	.79	.66	.86	.55	.76	.80	.80	.73
Task Orientation	.59	.66	.73	.69	.75	.68	.67	.63
Cooperation	.79	.73	.83	.93	.83	1.01	.95	.97
Equity	.90	.80	.78	.88	.90	.86	.76	.75
Differentiation	---	---	.92	.94	.89	1.02	.83	.81
Computer Usage	.70	.98	.95	.74	1.03	.91	.91	.57
Young Adult Ethos	.82	.69	.81	.91	.64	.76	.75	.72

RMR, CFI and TLI indices are reported (Organisation for Economic Co-operation and Development [OECD], 2009).These fit indices can be broadly characterized under three categories: absolute fit, fit adjusting for model parsimony, and comparative or incremental fit (Akıncı, 2007). Because each type of index provides different information about model fit, researchers are advised to consider and report at least one index from each category (Bentler, 1990). Fit indices such as $\chi 2$/sd, SRMR, RMR, RMSEA, CFI, TLI which are popular in the applied literature (Kline, 2005) and, more importantly, have favorable performance in Monte Carlo simulation research were evaluated and reported in this study (Brown, 2006; Paxton, Curan, Bollen, Kirby, & Chen, 2001). Other widely used indices such as the goodness-of-fit index and adjusted goodness-of-fit index are not included because of evidence of their poor behavior in simulation studies (Hu & Bentler, 1998; Marsh, Balla, & McDonald, 1988).

Results

Results of exploratory factor analysis suggested that three items loaded on more than one factor and removing them would result with 10 factors structure. After three items were removed the Principal components factor analysis assigned the 77 items to ten factors with eigenvalues above unity. These ten factors accounted for 57.24% of the total variance. A varimax rotation revealed that all items had loadings above 0.4 on their a priori scales and less than 0.4 on the remaining nine scales.

Confirmatory factor analysis was conducted with remaining 77 items to test for the original factor structure of TROFLEI. Goodness of fit indices of confirmatory factor analysis indicated a good fit between the original model and data ($\chi 2$ /sd=2,95, RMSEA=0.051, RMR=0.078, SRMR=0.056, CFI=0.97, TLI=0.97). The 90% confidence interval for RMSEA is found to be 0050- 0052; these values indicate that the model fits data within the acceptable limits. Factor loadings resulted from the confirmatory factor analysis for Turkish actual form of the TROFLEI for each item is given in Table 1. Cronbach alpha coefficients varied between 0.81 and 0.92. Corrected item-total correlations ranged from 0.33 to 0.67. According to t-test results, differences between each item's means of upper 27% and lower 27% points were significant

Although completely standardized loadings > 1.0 are generally considered to be indicators of wrong doing, Jöreskog (1999) has demonstrated instances where such estimates are valid (i.e., models that have multicollinearity). Given the empirical reality that several classroom environment dimensions overlap and TROFLEI has 10 scales this result is not surprising. These values suggest that the TROFLEI's scales are distinct but tend to overlap. These results confirm the widely-held view that classroom environment instruments tend to have conceptually distinct but empirically-overlapping scales (Fraser, 1998).

Discussion

This article has reported the validation of a Turkish adaptation of Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) which was developed by Aldridge et al. (2004). Using a sample of 446 male and 539 female high school students in İstanbul, this study showed the Turkish actual form of TROFLEI to be a valid measure of classroom environment. In contrast to original 80 items scale, Turkish form of TROFLEI consisted of

77 items after 3 items were dropped. Exploratory and confirmatory factor analysis results supported the original 10 factor structure. Differentiation scale consisted of six items and student cohesiveness scale consisted of seven items in Turkish form instead of the original eight items in each scale. The Cronbach alpha coefficients varied between 0.81 and 0.92. Corrected item-total correlations ranged from 0.33 to 0.67. According to t-test results, differences between each item's means of upper 27% and lower 27% points were significant. Goodness of fit indices of confirmatory factor analysis indicated a good fit between the original model and data ($\chi 2$ /sd=2,95, RMSEA=0.051, RMR=0.078, SRMR=0.056, CFI=0.97, TLI=0.97). The results of this research provide strong evidence of the sound psychometric properties of Turkish form of TROFLEI. Since the validity results of the instrument suggest that TROFLEI can be used for future research on learning environments in Turkey, this study will both motivate and facilitate the growth of learning environment research in Turkey.

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